

PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-221-M-1

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2010 Survey Report

San Augustine City Lake

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in San Augustine City Lake were surveyed in 2010 using electrofishing and trap netting and in 2011 using gill netting. A vegetation and access survey was conducted in 2010. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir description:** San Augustine City Lake is an impoundment of Carrizo and Caney Creeks. The City of San Augustine is the reservoir's controlling authority. Primary uses are water supply and recreation. This reservoir has a surface area of 200 acres, a shoreline length of 5.5 miles, and a mean depth of 10 feet. Water level fluctuations average 3 feet annually. Boat and bank access is adequate, with one boat ramp present.
- **Management history:** Important sport fish include largemouth bass, white and black crappie, and catfish. The management plan from the 2002 survey report included changing the 18-inch minimum length limit for largemouth bass to a 14- to 18-inch slot-length limit. The slot-length limit was implemented in 2004. Based on 2010 electrofishing results, the slot-length limit has not had any detectable affect on increasing the numbers of 14- to 18-inch largemouth bass. Sportfish body condition was adequate but prey fish abundance was less than desired. Hydrilla has been problematic over the years, covering approximately 75% of the reservoir surface area in 2002. From 2002-2003, triploid grass carp were stocked at a rate of 4/vegetated-acre (600 fish total) in an attempt to reduce hydrilla coverage to 10-15%. Since these stockings, coverage steadily declined, and no hydrilla has been observed since 2007.
- **Fish community**
 - **Prey species:** Threadfin and gizzard shad were present in the reservoir but abundance was low. Electrofishing catch of sunfish was moderate and comprised mostly of bluegill, redbreast, and redear sunfish with few fish over 6 inches in length.
 - **Catfishes:** Numbers of channel catfish have improved, indicating increased recruitment and/or survival. Channel catfish abundance likely increased due to the elimination of hydrilla. This change likely resulted in nutrient shifts favoring channel catfish prey abundance. Largemouth bass recruitment has also declined since hydrilla disappeared, reducing predation on channel catfish and leading to an increase in abundance.
 - **Largemouth bass:** Largemouth bass were moderately abundant. Size structure has remained consistent from past surveys with most fish <15 inches in length. Largemouth bass were in moderate condition. The current largemouth bass water body record is 13.13 lbs set in March 2006.
 - **Crappies:** Relative abundance and size structure of white crappie was good. Growth rates for white crappie were good with most fish reaching legal size in 2.0 years, but body condition was poor. Only white crappie was observed, but black crappie had been collected in the past.
- **Management strategies:** Continue to manage largemouth bass with a 14- to 18-inch slot-length limit. Continue to monitor for re-occurrence of hydrilla through annual aquatic vegetation surveys. Conduct electrofisher, trap net, gill net, and access surveys in 2014 and 2015. Conduct annual aquatic vegetation surveys (2011-2014).

INTRODUCTION

This document is a summary of fisheries data collected from San Augustine City Lake from June 2010 through May 2011. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2010-2011 data for comparison.

Reservoir Description

San Augustine City Lake is a 200-acre impoundment constructed in 1952 on Carrizo and Caney Creeks (Table 1). It is located in San Augustine County approximately 5 miles east of San Augustine and is operated and controlled by the City of San Augustine. Primary water uses included municipal water supply and recreation. Secchi disc readings are typically 2-4 feet. Habitat at time of sampling consisted of rocks, some standing timber, and limited aquatic vegetation. Native aquatic plants present are spikerush and American lotus. Hydrilla was first discovered in the late 1990s. Residential shoreline development comprised an estimated 30% of the shoreline. The majority of the land surrounding the reservoir is used for agriculture and timber production.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Ashe and Driscoll 2007) included:

1. Continue annual monitoring of aquatic vegetation (2007-2010). If hydrilla coverage were to expand beyond acceptable levels, meet with city officials and angling public to develop an integrated aquatic vegetation management plan.
Action: Triploid grass carp were stocked at a rate of 4 fish/vegetated-acre in 2002 and 2003. Aquatic vegetation surveys have been conducted annually since 2003. No hydrilla has been observed since 2007.
2. Continue to remain vigilant to identify giant salvinia during annual aquatic vegetation surveys with plans to initiate eradication or control response if any plants are found.
Action: Annual aquatic vegetation surveys have been conducted since 2003. No giant salvinia has been observed or reported.
3. Recommend improvements of access facilities to the City Council via discussions with the city manager.
Action: Recommendations have continued to be provided to the City of San Augustine regarding improvements to the boat ramp (i.e., road surface repairs and accommodations for the physically challenged). However, due to budget constraints no improvements have been made.
4. Continue to monitor largemouth bass size structure and growth to assess the success of the implemented slot limit by fall electrofishing.
Action: A fall electrofishing survey was conducted in 2010.

Harvest regulation history: Sport fishes in San Augustine City Lake are currently managed with statewide regulations with the exception of largemouth bass (Table 2). From 1990 to 2003, largemouth bass were managed with an 18-inch minimum length limit. A 14- to 18-inch slot length limit was implemented in 2004 to restructure the largemouth bass population, improve growth rate, and provide opportunities for anglers to catch increased numbers of larger bass.

Stocking history: Sharelunker largemouth bass fingerlings (4,592) were stocked in 2006. Triploid grass carp were stocked in 2002 and 2003. Florida largemouth bass were stocked in 1979, 1980, and again in 1992. Threadfin shad were introduced in 1979 and stocked again in 2000 and were still present in the reservoir in 2010 (Table 3).

Vegetation/habitat history: San Augustine City Lake aquatic vegetation coverage has declined significantly since 2003. The controlling authority stocked triploid grass carp in 2002 and 2003 to reduce hydrilla that had become problematic. The reservoir had nearly 75% hydrilla coverage prior to the triploid grass carp stockings. No hydrilla has been observed since 2007. Native vegetation is limited to less than 3 acres (spikerush and American lotus).

Water transfer: All water rights from San Augustine City Lake are held by the City of San Augustine for municipal water supply. There is a permanent pumping station on the reservoir that supplies 100% of the municipal water to the City of San Augustine. Additionally, water is transferred to Bland Lake Water Supply and San Augustine Water Supply for municipal water within San Augustine County.

METHODS

Fishes were collected by electrofishing (1 hour at 12, 5-min stations), trap netting (5 nets nights at 5 stations), and gill netting (5 net nights at 5 stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing and for gill nets as the number of fish per net night (fish/nn). All survey sites were randomly selected and the electrofishing, trap net, and gill net surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2009). Aquatic vegetation and access surveys were performed according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2009).

Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), as defined by Guy et al. (2007)], and condition indices [relative weight (W_r)] were calculated for target fishes according to Anderson and Neumann (1996). Relative standard error ($RSE = 100 \times SE$ of the estimate/estimate) was calculated for all CPUE statistics. Average ages of 10-inch (9.5 – 10.5 inches) white crappie were determined from otoliths. Water level data is not available.

RESULTS AND DISCUSSION

Habitat: Littoral zone habitat is limited and consisted primarily of overhanging brush (Ashe and Driscoll 2007) and approximately 2.0 acres of spikerush and 0.8 acres of American lotus.

Prey species: Electrofishing catch rate of threadfin shad was 76.0/h in 2010 (Appendix A), which is higher than that observed in 2006 (53.0/h) and 1999 (11.0/h). Gizzard shad abundance was low (6.0/h; Appendix A). Redbreast and bluegill sunfish were the predominant prey species with electrofishing catch rates of 171.0/h for each species in 2010 (Figures 1 and 2). Redbreast abundance was considerably higher in 2010 (171.0/h) compared to what was observed in 2006 (67.0/h) and 1999 (7.0/h). Total CPUE of bluegill in 2010 (171.0) was lower from what was observed from surveys in 2006 (437.0/h) and 1999 (284.0/h), and size structure continued to be dominated by small individuals. Catch rate trends of redbreast sunfish and bluegill likely resulted from the decrease in aquatic vegetation observed since triploid grass carp were stocked. Redear sunfish were also present, but abundance in 2010 (49.0/h) was significantly lower than what was observed in 2006 (115.0/h) (Figure 3). Overall, prey species abundance was moderately low.

Channel catfish: The gill net catch rate of channel catfish improved in 2010 (4.2/nn) compared to levels observed in 2007 (0.4/nn) and in 2003 (1.2/nn) (Figure 4). Hydrilla had become problematic in 2002 with coverage exceeding 75% of the reservoir surface area. Excessive hydrilla coverage likely suppressed catfish growth and abundance. Hydrilla has not been observed since 2007. Trophic dynamics of the reservoir likely changed with decreased aquatic vegetation growth, possibly leading to increases in preferred food items (namely benthic invertebrates) for channel catfish. Similar relationships between hydrilla coverage and channel catfish catch rates have been observed at Nacogdoches Reservoir (Driscoll and Parks 2001) and Martin Creek Reservoir (Ashe and Driscoll 2006).

Largemouth bass: The electrofishing catch rate of largemouth bass in the fall of 2010 (69.0/h) was less than catch rates observed in 2006 (132.0/h) and 1999 (78.0/h) (Figure 5). Recruitment rates have likely decreased due to decline in aquatic vegetation coverage. The length-frequency distribution was similar between years with the majority of fish less than 15 inches in length (PSD range = 35 – 51).

Average age at 14 inches (13.5 to 14.5 inches) was 2.3 years (N = 13; range = 2 to 3 years) in 2006. Length-at-age for largemouth bass was not calculated in 2010 due to an inadequate number of fish caught during the fall electrofishing survey. Body condition (W_t , range = 74 - 88) indicated that forage abundance was moderately low.

Crappies: Only white crappie was observed during the 2010 trap net survey, but black crappie have been collected in prior surveys. Catch rate of white crappie in 2010 (20.2/nn) was greater than the catch rate observed in 2006 (5.0/nn) and 2002 (0.4/nn) (Figure 6). Low catch rates observed in 2006 and 2002 were likely due to excessive hydrilla coverage that may have reduced sampling efficiency of trap nets. Average age of white crappie at 10 inches (9.5 to 10.5 inches) was 2.1 years (N=21; range = 2 to 3 years) in 2010.

Fisheries management plan for San Augustine City Lake, Texas

Prepared – July 2011

ISSUE 1: Hydrilla in San Augustine City Lake was first documented by TPWD in 1998. Hydrilla was problematic with coverage reaching 75% of the surface area by 2002. Triploid grass carp were stocked at a rate of 4/vegetated-acre in 2002 and 2003, and hydrilla steadily declined. Since 2007, no hydrilla has been observed. San Augustine city officials stated that hydrilla enhanced water quality and they desired the plant to return. However, at its peak coverage access was limited and lakeside homeowners wanted hydrilla eradicated.

MANAGEMENT STRATEGY

1. Continue to monitor aquatic vegetation annually (2011-2014). If hydrilla coverage expands beyond an acceptable coverage prompting public complaint within the next 4 years, meet with city officials and angling public to develop an integrated aquatic vegetation management plan.

ISSUE 2: Sunfish and largemouth bass abundance is moderately low, likely resulting from limited littoral habitat.

MANAGEMENT STRATEGY

1. Discuss a water willow or other grass carp resistant plant introduction with the City of San Augustine.

ISSUE 3: Since 1998, recommendations have been provided to the City of San Augustine regarding improvements to the boat ramp (i.e. road surface repairs and access at lower lake levels). However, due to budgetary constraints limited improvements have been made to the boat ramp.

MANAGEMENT STRATEGY

1. Continue to recommend improvements at the access point.

ISSUE 4: From 1990 to 2003, largemouth bass were managed with an 18-inch minimum length limit. A 14- to 18-inch slot length limit was implemented in 2004 to improve largemouth bass size structure, growth, and size of bass caught by anglers. Limited recruitment of largemouth bass into the slot limit has been observed.

MANAGEMENT STRATEGY

1. Continue to monitor largemouth bass size structure and growth to assess the success of the implemented slot-limit by fall electrofishing (2014).

ISSUE 5: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, giant salvinia can multiply rapidly fouling swimming beaches, restricting angler access, and uptake nutrients that benefit native vegetation. The financial costs of controlling and/or eradicating invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
2. Contact and educate marina owners about invasive species, and provide them with posters and

literature so they can educate their customers.

3. Educate the public about invasive species through the use of media and the internet.
4. Discuss invasive species when presenting to constituent and user groups.
5. Document existing and future inter-basin water transfers to facilitate potential invasive species responses.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes annual aquatic vegetation surveys and mandatory monitoring in 2014-2015 (Table 4). Annual aquatic vegetation surveys are required to monitor hydrilla coverage and inspect for new invasive plant infestations.

LITERATURE CITED

- Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- Ashe, D., and T. Driscoll. 2007. Statewide freshwater fisheries monitoring and management program survey report for San Augustine City Lake, 2006. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-32, Austin.
- Ashe, D., and T. Driscoll. 2006. Statewide freshwater fisheries monitoring and management program survey report for Martin Creek Reservoir, 2005. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-31, Austin.
- Driscoll, T., and J. Parks. 2001. Statewide freshwater fisheries monitoring and management program survey report for Nacogdoches Reservoir, 2000. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-26, Austin.
- Guy, C.S., R.M. Neuman, D.W. Willis, and R.O. Anderson. 2007. Proportional size distribution (PSD): A further refinement of population size structure index terminology. Fisheries 32(7):348.

Table 1. Characteristics of San Augustine City Lake, Texas.

Characteristic	Description
Year constructed	1952
Controlling authority	City of San Augustine
County	San Augustine
Reservoir type	Mainstream
Shoreline development index (SDI)	2.8
Conductivity	140 umhos/cm

Table 2. Harvest regulations for San Augustine City Lake.

Species	Bag Limit	Minimum-Maximum Length (inches)
Catfish: channel and blue catfish, their hybrids and subspecies	25 (in any combination)	12 - No Limit
Catfish, flathead	5	18 - No Limit
Bass, largemouth	5	14 – 18
Crappie: white and black crappie, their hybrids and subspecies	25 (in any combination)	10 - No Limit

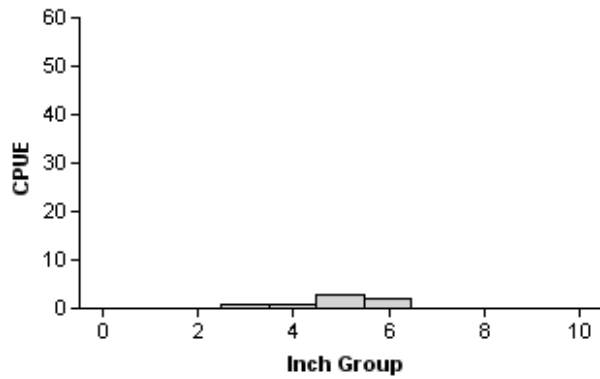
Table 3. Stocking history of San Augustine City Lake, Texas. Size categories are: FGL = 1-3 inches; AFGL = 8 inches, ADL = adults.

Species	Year	Number	Size
Florida largemouth bass	1979	10,000	FGL
	1980	10,000	FGL
	1992	20,000	FGL
	Total	40,000	
Sharelunker largemouth bass	2006	4,592	FGL
Threadfin shad	1979	1,200	AFGL
	2000	3,300	ADL
	2000	2,300	AFGL
	Total	6,800	
Triploid grass carp	2002	320	AFGL
	2003	280	AFGL
	Total	600	

Redbreast Sunfish

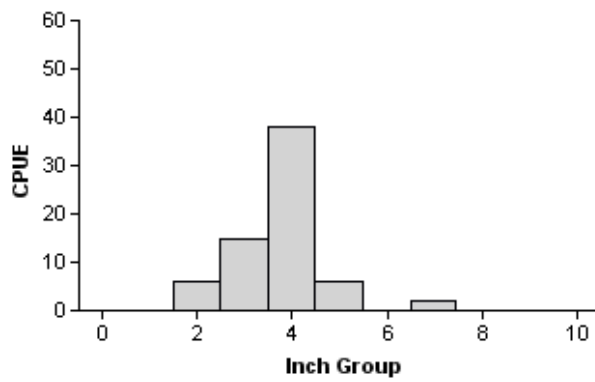
1999

Effort = 1.0
Total CPUE = 7.0 (49; 7)



2006

Effort = 1.0
Total CPUE = 67.0 (40; 67)



2010

Effort = 1.0
Total CPUE = 171.0 (19; 171)

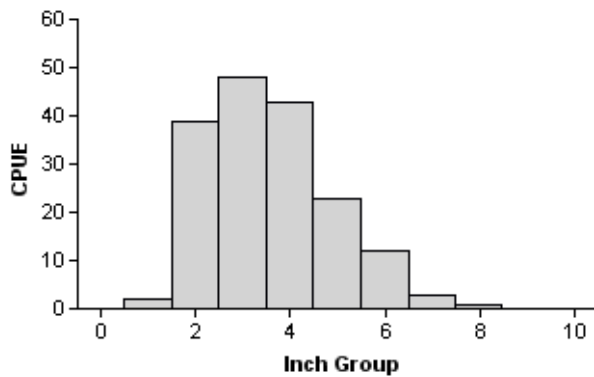
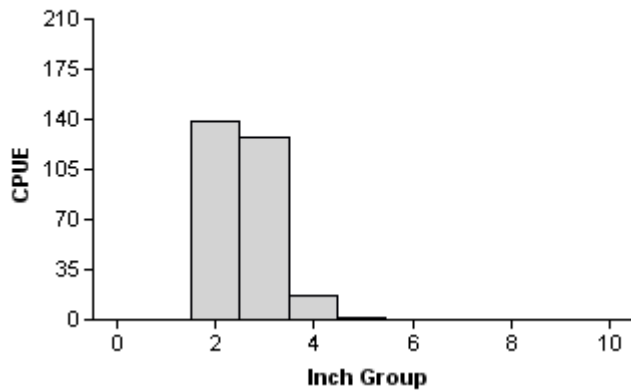


Figure 1. Number of redbreast sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, San Augustine City Lake, Texas, 1999, 2006, and 2010.

Bluegill

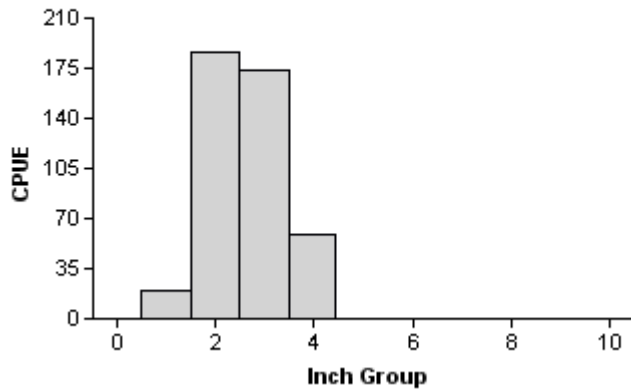
1999

Effort = 1.0
Total CPUE = 284.0 (21; 284)



2006

Effort = 1.0
Total CPUE = 437.0 (18; 437)



2010

Effort = 1.0
Total CPUE = 171.0 (18; 171)

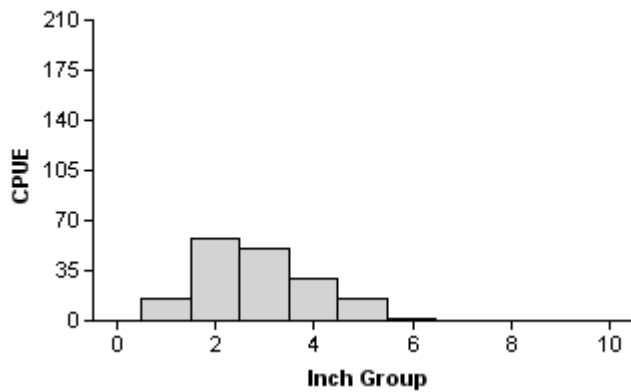
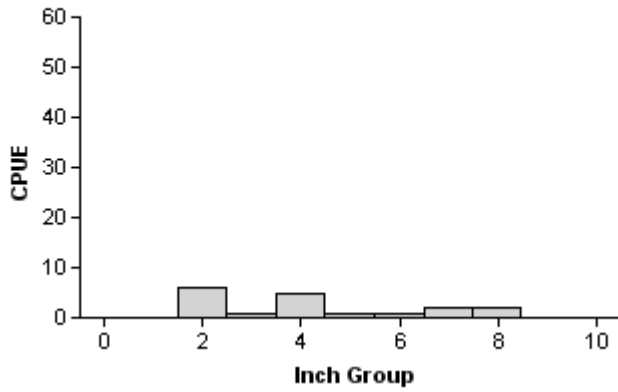


Figure 2. Number of bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, San Augustine City Lake, Texas, 1999, 2006, and 2010.

Redear Sunfish

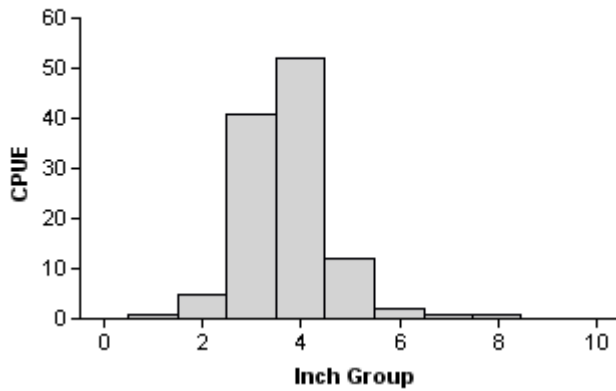
1999

Effort = 1.0
Total CPUE = 18.0 (25; 18)



2006

Effort = 1.0
Total CPUE = 115.0 (20; 115)



2010

Effort = 1.0
Total CPUE = 49.0 (18; 49)

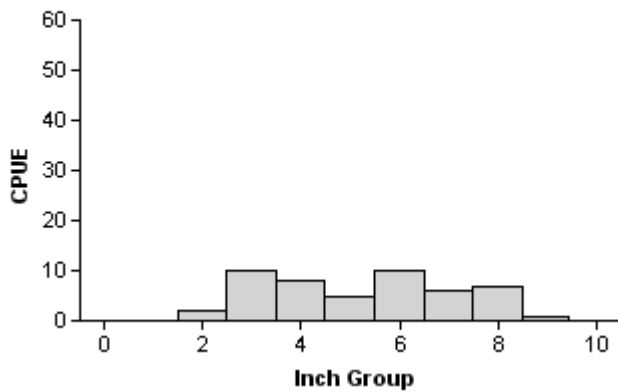
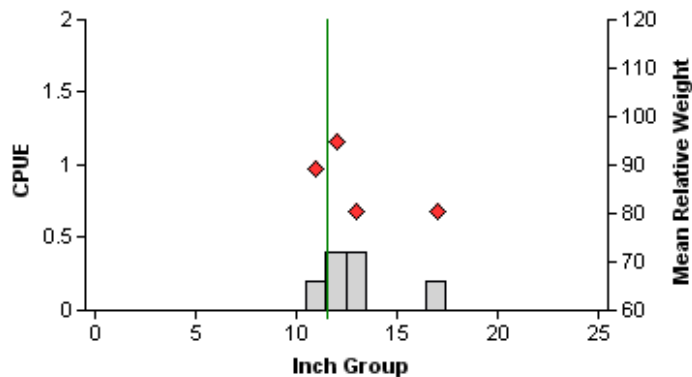


Figure 3. Number of redear sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, San Augustine City Lake, Texas, 1999, 2006, and 2010.

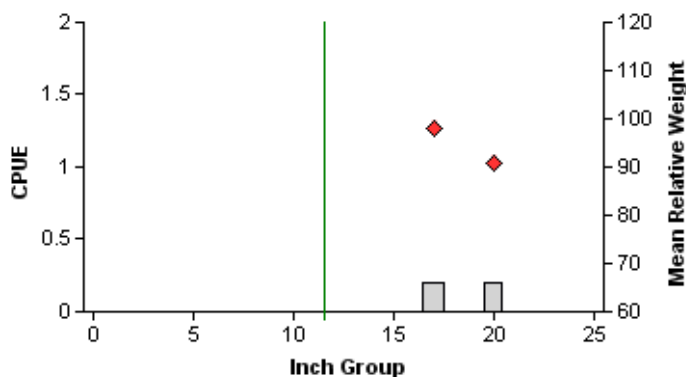
Channel Catfish

2003



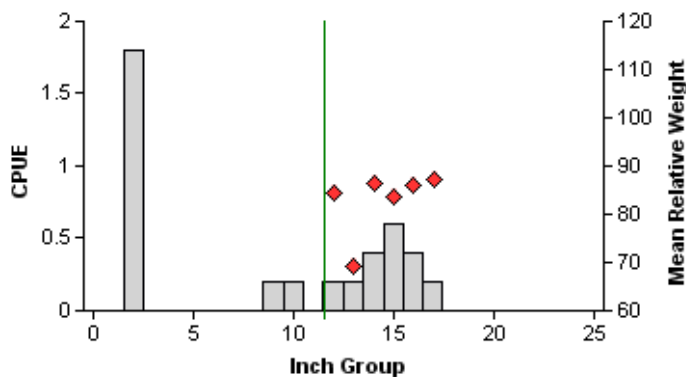
Effort = 5.0
Total CPUE = 1.2 (41; 6)
PSD = 17 (15.2)

2007



Effort = 5.0
Total CPUE = 0.4 (100; 2)
PSD = 100 (0)

2011



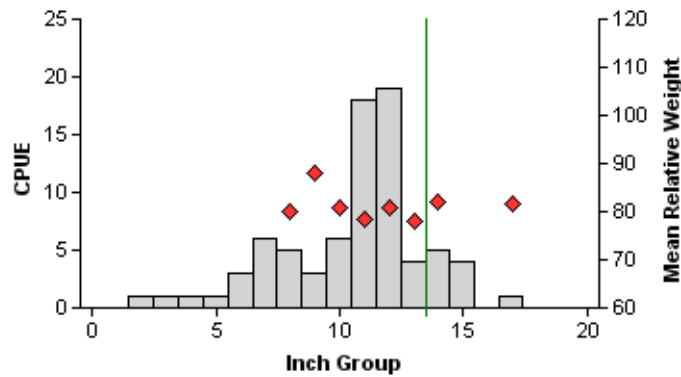
Effort = 5.0
Total CPUE = 4.2 (71; 21)
PSD = 30 (15.7)

Figure 4. Number of channel catfish caught per net night (CPUE, bars), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, San Augustine City Lake, Texas, 2003, 2007, and 2011. Vertical lines indicates minimum length limit at time of survey.

Largemouth Bass

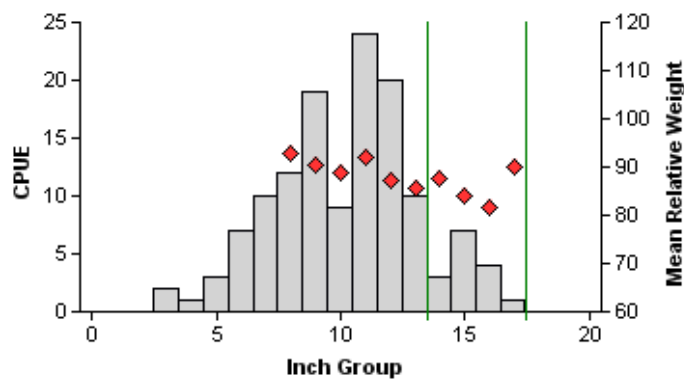
1999

Effort = 1.0
Total CPUE = 78.0 (11; 78)
PSD = 51 (5.5)



2006

Effort = 1.0
Total CPUE = 132.0 (16; 132)
PSD = 41 (5.1)



2010

Effort = 1.0
Total CPUE = 69.0 (12; 69)
PSD = 35 (3.7)

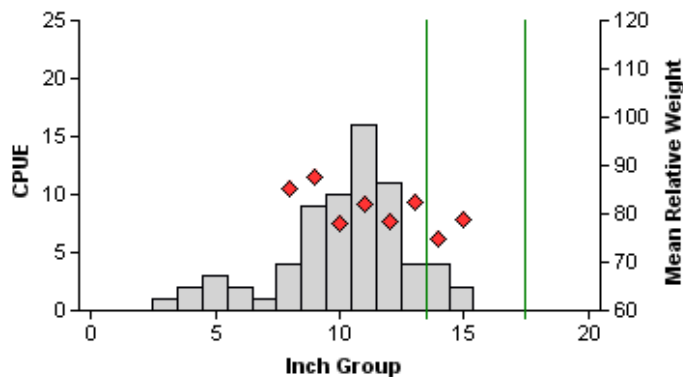
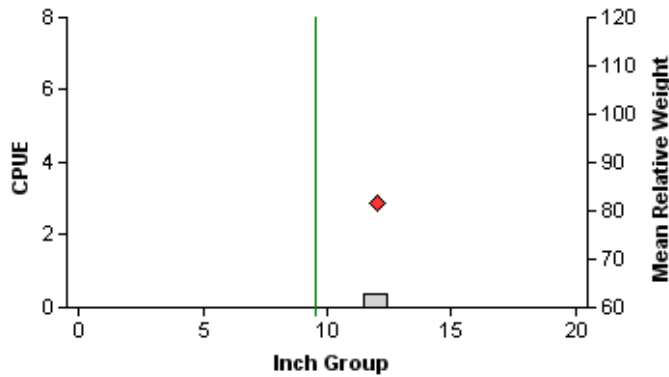


Figure 5. Number of largemouth bass caught per net night (CPUE, bars), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, San Augustine City Lake, Texas, 1999, 2006, and 2010. Vertical lines indicate minimum length limit for 1999 and a slot length limit for 2006 and 2010.

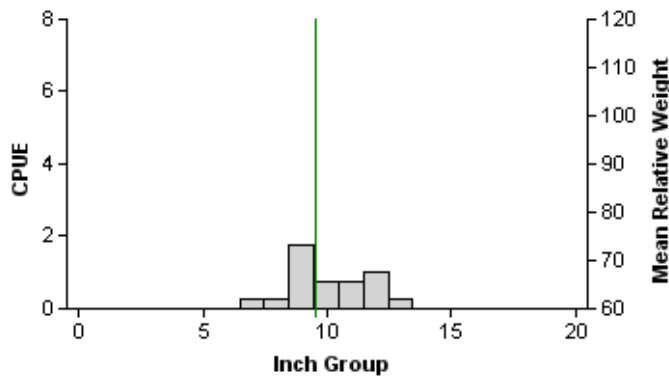
White Crappie

2002



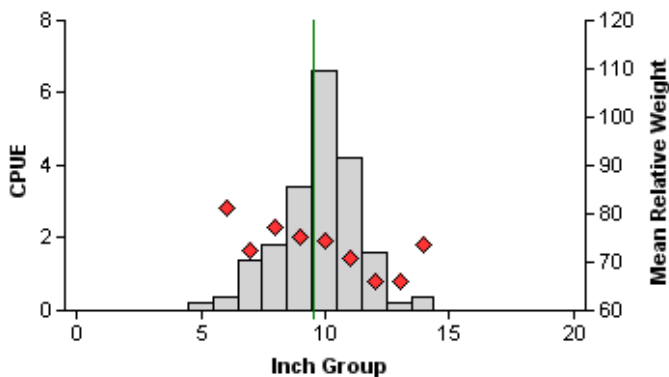
Effort = 5.0
Total CPUE = 0.4 (100; 2)
PSD = 100 (0)

2006



Effort = 4.0
Total CPUE = 5.0 (38; 20)
PSD = 95 (3.5)

2010



Effort = 5.0
Total CPUE = 20.2 (44; 101)
PSD = 90 (2.1)

Figure 6. Number of white crappie caught per net night (CPUE, bars), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, San Augustine City Lake, Texas, 2002, 2006, and 2010. Vertical lines indicates minimum length limit at time of survey.

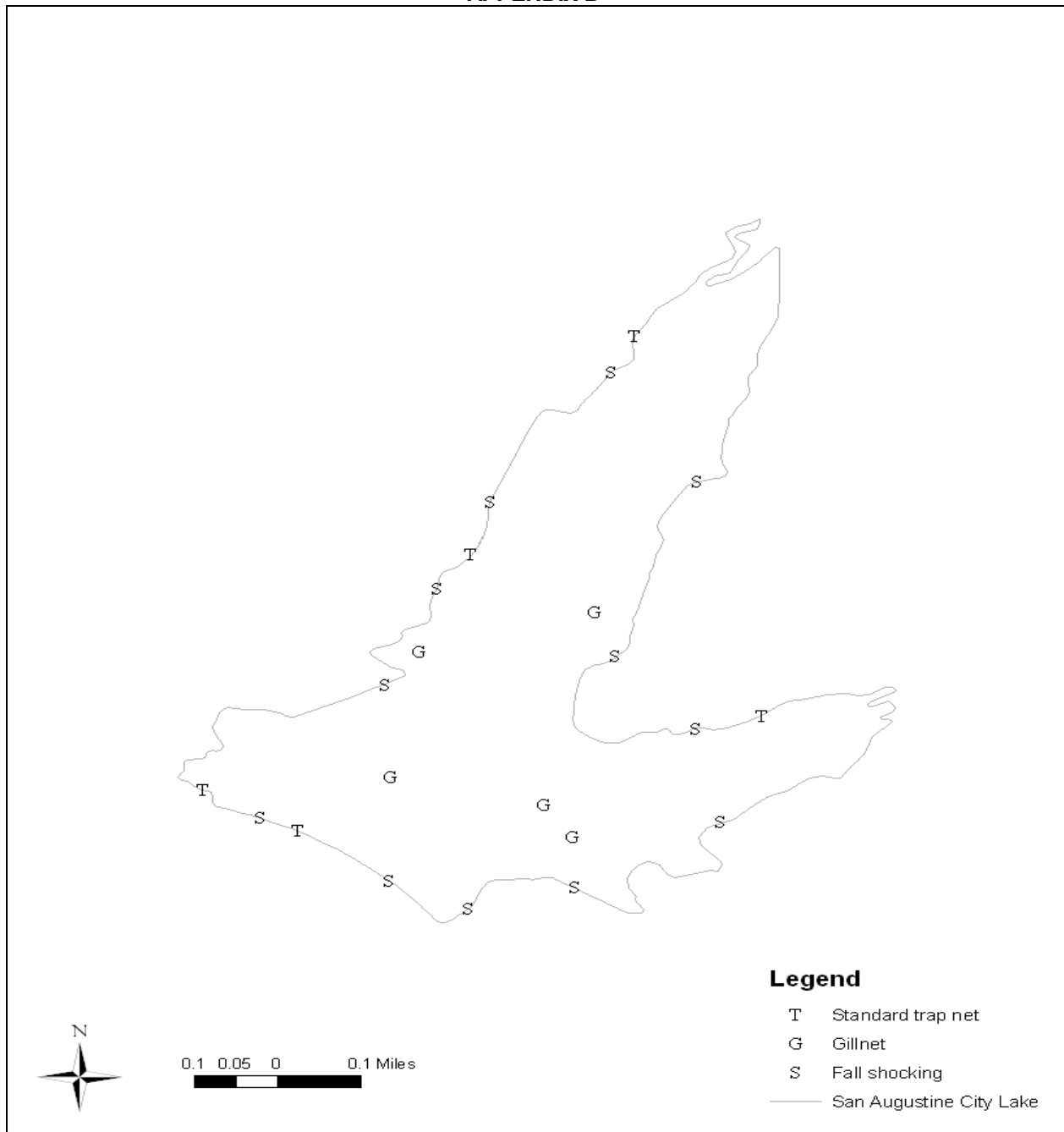
Table 4. Proposed sampling schedule for San Augustine City Lake, Texas. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

Survey Year	Electrofisher	Trap Net	Gill Net	Vegetation Survey	Access Survey	Report
2011-2012				A		
2012-2013				A		
2013-2014				A		
2014-2015	S	A	S	S	S	S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from San Augustine City Lake, Texas, 2010-2011.

Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard shad					6	6.0
Threadfin shad					76	76.0
Spotted sucker	5	1.0				
Channel catfish	21	4.2				
Redbreast sunfish					171	171.0
Green sunfish					14	14.0
Warmouth					16	16.0
Bluegill	4	0.8			171	171.0
Longear sunfish					12	12.0
Redear sunfish					49	49.0
Largemouth bass	2	0.4			69	69.0
White crappie	33	6.6	101	20.2		

APPENDIX B

Location of sampling sites, San Augustine City Lake, Texas, 2010-2011. Gill netting, trap netting, and fall electrofishing stations are indicated by G, T, and S respectively.